

REMARKS**Claim Status**

Claims 26-52 are currently pending. New Claim 53 is now added.

Claim Amendments

New Claim 53 is added. New Claim 53 is based on Claim 26 and further recites the concentration of the phosphoric acid in the resulting membrane as disclosed on page 37, lines 6-14 of the English translation of the instant application.

Rejection of Claims Under 35 U.S.C. § 102

Claims 26-29, 31, 35-37, 41-44 and 46-52 are rejected under 35 U.S.C. § 102(b) as being anticipated by US Patent Publication 2004/0062969 ("Sakaguchi").

The Examiner maintained the rejection based on inherency. The Examiner previously asserted that Sakaguchi teaches the steps A) through E) of base Claims 26, 48 and 51, but does not expressly teach step F), partial hydrolysis of the polyphosphoric acid. The Examiner stated that the polyphosphoric acid moieties of the membranes of Sakaguchi are expected to inherently partially hydrolyze, thus resulting in the same product as the one claimed by the instant claims. The Examiner referred to paragraphs [0210] and [0254]-[0260] of Sakaguchi, and further relied on "Polyphosphoric Acid Assay" ("Innophos"), for their teaching that the polyphosphoric acid is hygroscopic and, therefore, is subject to partial hydrolysis under atmospheric conditions.

Applicants previously argued that the Examiner's argument that Sakaguchi inherently teaches all the steps of Claims 26, 48 and 51 is based on an incorrect interpretation of the teaching of Sakaguchi, including paragraphs [0210] and [0254]-[0260]. Specifically, Applicants noted that these paragraphs teach *complete removal*, not partial hydrolysis, of the polyphosphoric acid moieties. For example, paragraph [0255] expressly states:

After completing the polymerization, the mixture was allowed to cool, poured into water, and the polymer obtained was repeatedly rinsed in a blender until pH test paper was neutralized. (*Emphasis added.*)

Because the pH is *neutral*, based on this description alone it is clear that polyphosphoric acid was *completely removed*, with no or little phosphoric acid left in the polymer. Whether this

removal of polyphosphoric acid involved hydrolysis is irrelevant: even if the hydrolysis occurred, the resulting product is by necessity very different from the product of a process recited by pending Claims 26, 48 and 51 because the acid (hydrolyzed or unhydrolyzed) has been removed.

The Examiner now takes the position that:

[a]lthough Sakaguchi *et al.* teach of rinsing the polymerized material until the pH is neutral, this is not an indication that no polyphosphoric acid remains in the polymer. (Office Action of September 24, 2008, page 10, first full paragraph.)

The Examiner further asserts that:

- “some of the polyphosphoric acid would remain in the polymerized product” (Office Action, page 10, first full paragraph);
- “Applicants has not shown that *all* of the polyphosphoric acid within the solution is removed” (Office Action, the paragraph bridging pages 10 and 11); and
- “[t]he rinsing only rids Sakaguchi *et al.*’s membrane of excess polyphosphoric acid” (Office Action, page 12, second paragraph).

Applicants respectfully disagree and submit that the Examiner’s assertions are scientifically incorrect and legally improper. Furthermore, Applicants submit that new Claim 53 is patentable over Sakaguchi for additional reasons.

First, Applicants submit that after “repeatedly rinsed in a blender until pH test paper was neutralized”, the polymer of Sakaguchi is likely to contain *no* (detectable) *polyphosphoric acid*. To support this assertion, Applicants submit herewith Exhibit A, the Material Safety Data Sheet for polyphosphoric acid (manufactured by SM Chemicals, India). Exhibit A, section 9 (page 2), states that polyphosphoric acid is *completely* soluble in water, with the formation of orthophosphoric acid. In other words, “repeated rinsing”, *i.e.* repeated removal of used water and addition of fresh water to the polymer comprising polyphosphoric acid will *completely* remove polyphosphoric acid (within the limit of detection). Furthermore, Applicants submit herewith as Exhibit B the Safety Data Sheet for orthophosphoric acid (manufactured by OM Group Ultra Pure Chemicals Ltd, UK). As stated in section 9 of Exhibit B (page 3), orthophosphoric acid is miscible in water in *all proportions*. In other words, as soon as it is

formed by the hydrolysis of polyphosphoric acid, orthophosphoric acid would be immediately removed by water (within the limit of detection).

Accordingly, the process employed by Sakaguchi will result in *complete* removal of polyphosphoric acid and the products of its hydrolysis. While it is possible that *individual molecules* of either the polyphosphoric acid or the orthophosphoric acids may remain within the polymer of Sakaguchi, the concentration of such products is expected to be below the limit of detection. Therefore, the Examiner's assertions that "not [...] *all* of the polyphosphoric acid within the solution is removed" and that "some of the polyphosphoric acid would remain in the polymerized product" are scientifically unfalsifiable. An unfalsifiable statement cannot form a basis of a claim rejection based on prior technical references.

Secondly, Applicants submit that the Examiner's position is legally untenable. The proper inquiry into patentability of a product-by-process claims, such as pending independent claims, is whether the *material* differences between the Applicants' products and those of Sakaguchi exist. The Examiner, instead, appears to concentrate on theoretical presence in the membranes of Sakaguchi of undetectably low amount of an ingredient, which, even if present, would not bridge the gap in physical properties between the membranes of Sakaguchi and those of Applicants.

Applicants direct the Examiner's attention to M.P.E.P. §2113, which states regarding product-by-process claims:

The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art [...] (*Emphasis added.*)

Applicants also direct the Examiner's attention to the decision of *In re Garnero*, 412 F.2d 276, 162 USPQ 221 (CCPA 1969), which is quoted in M.P.E.P. §2113. In *In re Garnero*, The court gave clear guidelines for examination of a product-by-process claim:

The correct inquiry [...] is whether the product defined by claim 1 is patentably distinguishable over the [*cited references*] in view of the structural limitation [...] (412 F.2d 276 at 279) (*Emphasis added.*)

In the instant case, evidence presented by Applicants (paragraphs [0254]-[0260] of Sakaguchi in view of Exhibits A and B) demonstrates that even if the polyphosphoric acid or the orthophosphoric acids could remain within the polymer of Sakaguchi, the concentration of such products is expected to be below the limit of detection. In contrast, Applicants teach *partial* hydrolysis of polyphosphoric acid. Applicants teach that the partial hydrolysis of polyphosphoric acid leads to strengthening the membrane and to decrease in the layer thickness (page 37, lines 21-25 of the English translation of the instant specification). Applicants teach that the degree of hydrolysis of polyphosphoric acid permits control over the conductivity of the membrane (page 39, lines 4-12). In other words, the presence of phosphoric acid within the membrane is one of the elements of Applicants' invention. This contrasts with the complete (within the limit of detection) removal of polyphosphoric acid and its hydrolysis products by Sakaguchi. Therefore, the "structural limitations" "implied by the process steps" of Applicants' base claims result, with necessity, in a product different from that disclosed in Sakaguchi.

Moreover, Applicants note that the teachings of Sakaguchi direct one of ordinary skill in the art *away* from raising the concentration of phosphoric acid above the limit of detection. Indeed, one of the stated objectives of Sakaguchi's invention is to provide "ion conductivity by introducing sulfonic acid groups or phosphoric acid groups into a polybenzazole compound" (Sakaguchi, paragraph [0021]). Sakaguchi further states that the "ion conductivity" of his membranes are due to the presence of phosphonic acid groups and sulfonic acid groups (Sakaguchi, paragraph [0122]). Thus, when Sakaguchi performs ion conductivity measurements, such as in Example 1 (Sakaguchi, paragraph [0259]), the presence of *additional* ion conductor, such as phosphoric acid, would be *undesirable*, as it would distort the measurements by inflating the value of conductivity. Accordingly, one of ordinary skill in the art would not, based on the teachings of Sakaguchi, raise the concentration of phosphoric acid above the limit of detection.

Finally, Applicants submit that new Claim 53 is patentable over Sakaguchi for yet another reason. Sakaguchi does not teach that the concentration of phosphoric acid in the membrane is from 10 to 80 mols of phosphoric acid per mol of a repeating unit of the polyazole polymer, as recited in new Claim 53. The presence of phosphoric acid in the recited range, however, confers unexpected advantages onto the Applicants' membranes, as stated above: improved mechanical strength and control over the conductivity of the membranes.

It is thus established that the process of Sakaguchi (polyphosphoric acid is removed) is different from the process of the instant base claims (polyphosphoric acid is retained, partially hydrolyzed). The difference between the products obtained by these different processes follows with necessity: the membranes of Sakaguchi do *not* contain polyphosphoric acid, while the membranes of Claims 26, 48 and 51 *do* contain such moieties.

Reconsideration and withdrawal of the rejection are requested.

Rejection of Claims Under 35 U.S.C. § 103

Dependent Claims 30, 32-34, 38-40, 45 and 46 are rejected over a combination of Sakaguchi in view of Matsuoka, Gerber, or Kerres. Applicants respectfully disagree.

Sakaguchi is discussed in detail above. Sakaguchi does not teach or suggest the membranes with polyphosphoric acid moieties.

Matsuoka, Gerber and Kerres each teach polymers made up of monomer units that may be used in the present invention, but do not teach or suggest membranes with partially hydrolyzed polyphosphoric acid moieties. Therefore, none of the deficiencies of Sakaguchi are overcome by the combination of references.

Reconsideration and withdrawal of these rejections is respectfully requested.


CONCLUSIONS

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue.

If the Examiner feels that a telephone conference would expedite prosecution of this application, she is invited to call the undersigned.

Respectfully submitted,

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By 

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Dated:

3/23/09

MATERIAL SAFETY DATA SHEET

POLY PHOSPHORIC ACID

1. Chemical Product and Company Identification

Product Name : Poly Phosphoric Acid (PPA)
Manufacturer : S M Chemicals
Address : S M Chemicals
311/312, Nand Prem, 142, Nehru Road, Vile Parle (E)
Mumbai- 400057
INDIA
Tel no. 91-22-26104202/26151500/26136732
Fax no. 91-22-26104201
Regd. Office
Plot No. 313/1, G I D C, Vapi -396195,
District Valsad, Gujarat
Tel No. 91-260-2781049/2780149/2781013
www.sandhya-group.com
socpl@vsnl.com

Emergency Contact No. : 91-22-26104202/26151500/26136732

2. Composition, Information on Ingredients

	CAS#	HS Code.	UN No.
Poly-Phosphoric Acid (P ₂ O ₅ content 83-85%)	7664-38-2	2809 2002	UN 1805

3. Hazards Identification

POTENTIAL HEALTH EFFECTS:

EYE: Corrosive, Causes Redness, pain and poor visibility

SKIN: Corrosive, Causes Redness, pain and burns

INHALATION: Corrosive, Causes sore throat, shortness of breath and dyspnoea

SIGNS AND SYMPTOMS: Eye, skin or respiratory tract irritation. Gastrointestinal disturbance, diarrhea

Physical & Chemical Hazards: Forms flammable & Explosive hydrogen through corrosion of metals. At high temperature:

Thermal decomposition giving corrosive products.

4. First Aid Measures

EYE: Wash immediately & abundantly with water for at least 15 minutes. Consult an ophthalmologist immediately.

SKIN: On contact with eyes, rinse immediately with plenty of water and seek medical advice.

INGESTION: Do not induce vomiting, rinse mouth and lips with plenty of water if The subject is conscious, then hospitalize immediately.

INHALATION: Move to fresh air. If required, provide oxygen or artificial respiration. Hospitalize.

NOTE TO PHYSICIANS: Treat symptomatically. (See Section 3 For Observable Signs/Symptoms).

5. Fire Fighting Measures

Suitable extinguishing media : Incase of Fire nearby: Dry Powder, Foam, Carbon dioxide(CO₂)

Specific Methods : In case of Fire: remove exposed containers. Cool containers with water spray.

Special Protective Equipment for Firefighters: Incase of Fire: wear a self-contained breathing apparatus and acid resistant clothing.

6. Accidental Release Measures

Personal precaution : Avoid contact with skin and eyes and inhalation of hot vapors.

Environmental protection : Do not allow material to be released to the environment. Do not let the product enter into drains. Contain by damming.

Methods for cleaning up :

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MATERIAL SAFETY DATA SHEET

POLY PHOSPHORIC ACID

Recovery : Pump into an inert labeled emergency container. Clean up puddle of Product immediately. Dilute the puddles with water & recover it.
Neutralization : Dilute cautiously with water & then process. Neutralize with an alkaline carbonate or neutralize with slaked lime (Filter the salt obtained –neutralize the liquid)

7. Handling and Storage

Handling

Technical measures/ Precautions : Storage & handling precautions applicable to products. Ensure appropriate exhaust & ventilation at Machinery. Provide showers, eye baths.

Safe handling advice : Avoid splashing when handling. Do not pour water onto the acid (Exothermic reaction)

Storage

Technical measures : Keep containers tightly closed in a cool, well-ventilated place.

Storage Information : Store in well-insulated area. Store protected from moisture & heat. Keep at temperature above 16 ° C Provide a catch-tank & an impermeable corrosion resistant floor with drainage to a neutralization tank within a bunked area. Provide anti-corrosion electrical equipment.

Incompatible Products : Bases-Quicklime Alcohols-Ketones-Amines Water Nitrates-Chlorates-Calcium Carbide Metals-Finely divided metals Combustible Material.

Recommended : Stainless steel 316 L-Carbon Steel (Vulcanized Rubber coated Steel)

PlasticMaterials (Polyurethane) SmallQuantities: Glass protected by a fitted metallic Covering.

To be avoided : Metals: Ordinary Steel, Copper, Aluminum, (and alloys)

8. Exposure Controls, Personal Protection

Protective Provisions : Ensure sufficient air exchange and/ or exhaust in working areas.

Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment.

Respiratory protection : In case of insufficient ventilation, wear suitable respiratory equipment.

Hand protection : Gloves.

Eye protection : Safety glasses / goggles. Face mask (in case of spattering).

Skin & body protection : Protective clothing Non-skid boots (Butyl rubber-chlorinated polyethylene-Neoprene-Polyvinyl Chloride).

Specific hygienic Measures : Avoid contact with skin and eyes and inhalation of hot.

9. Physical and Chemical Properties

Physical State : Viscous liquid

Color : Colorless

Odour : none

Solubility in Water : Completely soluble, formation of Orthophosphoric acid.

Solubility in solvents : Soluble in Alcohols

Specific gravity : 1.85-2.05 depending upon the concentration.

10. Stability and Reactivity

Conditions to avoid : Store protected from moisture & heat

Materials to avoid : Bases, Quicklime: Exothermic reaction-Violent reaction Alcohols- ketones -Amines:

Exothermic reaction Water: Very exothermic reaction & possibility of spitting Nitrates-Chlorates – Calcium Carbide:

Explosive reaction (Flammability) Metals – finely divided metals Combustible materials: Overheating and ignition.

Hazardous Decomposition products: Forms flammable & explosive hydrogen through corrosion of metals at Temperatures above 200 ° C. Formation of: Polyphosphoric Acid (Dehydration) At high temperature: Thermal decomposition giving corrosive products: Oxydes of Phosphorus

Further Information : Hygroscopic product

MATERIAL SAFETY DATA SHEET

POLY PHOSPHORIC ACID

11. Toxicological Information

Acute toxicity : May be harmful by inhalation, ingestion, or skin absorption. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes and skin.

Inhalation : Inhalation may result in spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting

Chronic Effects : Target Organ(S): Liver, Blood, Bone Marrow

Additional toxicological Information: To the best of our knowledge the acute and chronic toxicity of this substance is not fully known. No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH

12. Ecological Information

Persistence/ degradability in water : Hydrolysis, formation of: H_3PO_4 (depends on the temperature) $t_{1/2}$ life = few days.

Aquatic Toxicity : -

Ecotoxicity : -

13. Disposal Considerations

Disposal of the Product : Recommendation: Consult state, local or national regulations for proper disposal. Dilute cautiously with water and then process. Neutralize with an alkaline carbonate or Neutralize with slaked lime (Filter the salt obtained- Neutralize the liquid).

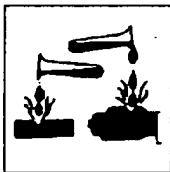
Recommendation : Disposal must be made according to official regulations.

14. Transport Information

UN number : UN 1805
Transport name : Poly phosphoric acid
ADR/RID/IMO Class : 8
Packing group : III
Label : 8

15. Regulatory Information

Symbol



16. Other Information

This information is based on our present state of knowledge. It should not therefore be constructed as guaranteeing specific properties of this product or their suitability for a particular application.

SAFETY DATA SHEET
ORTHOPHOSPHORIC ACID 80 - 90 %

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1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY / UNDERTAKING

Product name: ORTHOPHOSPHORIC ACID 80 - 90 %
CAS number: 7664-38-2
EINECS number: 231-633-2
Index number: 015-011-00-6
Product code: REM079
Synonyms: PHOSPHORIC ACID...100%
PHOSPHORIC ACID.80% - 85%
Company name: OM Group Ultra Pure Chemicals Ltd
Amber Business Centre
Riddings
Alfreton
Derbyshire
DE55 4DA
United Kingdom
Tel: +44 (0) 1773 844200
Fax: +44 (0) 1773 844244
Emergency tel: +44 (0) 1773 844333

2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous ingredients: ORTHOPHOSPHORIC ACID 80 - 90 % 70-90%

3. HAZARDS IDENTIFICATION

Main hazards: Causes burns.

4. FIRST AID MEASURES (SYMPTOMS)

Skin contact: Blistering may occur. Progressive ulceration will occur if treatment is not immediate.
Eye contact: Corneal burns may occur. May cause permanent damage.
Ingestion: Corrosive burns may appear around the lips. Blood may be vomited. There may be bleeding from the mouth or nose.
Inhalation: There may be shortness of breath with a burning sensation in the throat. Exposure may cause coughing or wheezing.

4. FIRST AID MEASURES (ACTION)

Skin contact: Remove all contaminated clothes and footwear immediately unless stuck to skin. Drench the affected skin with running water for 10 minutes or longer if substance is still on skin. Transfer to hospital if there are burns or symptoms of poisoning.
Eye contact: Bathe the eye with running water for 15 minutes. Transfer to hospital for specialist examination.
Ingestion: Wash out mouth with water. Do not induce vomiting. Give 1 cup of water to drink every 10

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SAFETY DATA SHEET ORTHOPHOSPHORIC ACID 80 - 90 %

minutes. If unconscious, check for breathing and apply artificial respiration if necessary. If unconscious and breathing is OK, place in the recovery position. Transfer to hospital as soon as possible.

Inhalation: Remove casualty from exposure ensuring one's own safety whilst doing so. If unconscious and breathing is OK, place in the recovery position. If conscious, ensure the casualty sits or lies down. If breathing becomes bubbly, have the casualty sit and provide oxygen if available. Transfer to hospital as soon as possible.

5. FIRE-FIGHTING MEASURES

Extinguishing media: Suitable extinguishing media for the surrounding fire should be used. Use water spray to cool containers.

Exposure hazards: Corrosive. In combustion emits toxic fumes.

Protection of fire-fighters: Wear self-contained breathing apparatus. Wear protective clothing to prevent contact with skin and eyes.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Notify the police and fire brigade immediately. If outside keep bystanders upwind and away from danger point. Mark out the contaminated area with signs and prevent access to unauthorised personnel. Do not attempt to take action without suitable protective clothing - see section 8 of SDS. Turn leaking containers leak-side up to prevent the escape of liquid.

Environmental precautions: Do not discharge into drains or rivers. Contain the spillage using bunding.

Clean-up procedures: Clean-up should be dealt with only by qualified personnel familiar with the specific substance. Absorb into dry earth or sand. Transfer to a closable, labelled salvage container for disposal by an appropriate method.

7. HANDLING AND STORAGE

Handling requirements: Avoid direct contact with the substance. Ensure there is sufficient ventilation of the area. Do not handle in a confined space. Avoid the formation or spread of mists in the air.

Storage conditions: Store in cool, well ventilated area. Keep container tightly closed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Workplace exposure limits

WEL (8 hr exposure limit): 1 mg/m³

WEL (15 min exposure limit): 2 mg/m³

Engineering measures: Ensure there is sufficient ventilation of the area.

Respiratory protection: Self-contained breathing apparatus must be available in case of emergency.

Hand protection: Impermeable gloves.

Eye protection: Tightly fitting safety goggles. Ensure eye bath is to hand.

Skin protection: Impermeable protective clothing.

SAFETY DATA SHEET
ORTHOPHOSPHORIC ACID 80 - 90 %

9. PHYSICAL AND CHEMICAL PROPERTIES

State: Liquid
 Colour: Colourless
 Odour: Odourless
 Solubility in water: Miscible in all proportions
 Viscosity: Viscous
 Viscosity value: 11cP
 Boiling point/range°C: 171
 Melting point/range°C: 28 at 90-%
 Vapour pressure: 0.03
 Relative density: 1.74
 pH: 2

10. STABILITY AND REACTIVITY

Stability: Stable under normal conditions.
 Conditions to avoid: Heat.
 Materials to avoid: Strong oxidising agents. Strong acids.
 Haz. decomp. products: In combustion emits toxic fumes.

11. TOXICOLOGICAL INFORMATION

Routes of exposure: Refer to section 4 of SDS for routes of exposure and corresponding symptoms.

12. ECOLOGICAL INFORMATION

Mobility: Readily absorbed into soil.
 Persistence and degradability: Biodegradable.
 Bioaccumulative potential: No bioaccumulation potential.
 Other adverse effects: Negligible ecotoxicity.

13. DISPOSAL CONSIDERATIONS

Disposal of packaging: Arrange for collection by specialised disposal company.
 NB: The user's attention is drawn to the possible existence of regional or national regulations regarding disposal.

14. TRANSPORT INFORMATION

ADR / RID

UN no: 1805	ADR Class: 8
Packing group: III	Classification code: C1
Shipping name: PHOSPHORIC ACID, LIQUID (ORTHOPHOSPHORIC ACID...80 - 90%)	
Labelling: 8	Hazard ID no: 80



SAFETY DATA SHEET
ORTHOPHOSPHORIC ACID 80 - 90 %

IMDG / IMO

UN no:	1805	Class:	8
Packing group:	III	EmS:	F-A,S-B
Marine pollutant:	NO	Labelling:	8

IATA / ICAO

UN no:	1805	Class:	8
Packing group:	III	Packing instructions:	819(P&CA); 821(CAO)
Labelling:	8		

15. REGULATORY INFORMATION

Hazard symbols: Corrosive.



Risk phrases: R34: Causes burns.

Safety phrases: S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

Note: The regulatory information given above only indicates the principal regulations specifically applicable to the product described in the safety data sheet. The user's attention is drawn to the possible existence of additional provisions which complete these regulations. Refer to all applicable national, international and local regulations or provisions.

16. OTHER INFORMATION

Legal disclaimer: The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. This company shall not be held liable for any damage resulting from handling or from contact with the above product.